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Information Centers in the United States Marine Corps: control of end-user computing

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INFORMATION CENTERS IN THE UNITED STATES MARINE CORPS: CONTROL OF END-USER COMPUTING

by

Paul William LeBlanc

March 1989

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The proliferation of personal computers and end-user computing (EUC) in the United States Marine Corps (USMC) during the last ten years is well documented and now plays an important role in USMC readiness. The control and planning of personal computers and EUC at the regional level is performed by the Information Systems Management Office (ISMO), the equivalent of the private industry's Information Center (IC). Unlike the USMC mainframe and telecommunications environments, the ISMO environment is loosely controlled from the Headquarters Marine Corps level. This fact has resulted in a "substantial inventory of incompatible equipment and software." (MCBul 5271, 1987, p. 4-6) This study concludes that the most significant limiting factor facing the Marine Corps' corporate strategy for control of its ISMO's is a lack of standards and specific direction. The requirement for developing a centralized, HQMC directed ISMO policy for control of ISMO resources was confirmed.

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Information Centers in the United States Marine Corps: Control of End-User Computing

by

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Major, United States Marine Corps
B.S., North Adams State College, 1976

Submitted in partial fulfillment of the requirements for the degree of

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from the

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ABSTRACT

The proliferation of personal computers and end-user computing (EUC) in the United States Marine Corps (USMC) during the last ten years is well documented and now plays an important role in USMC readiness. The control and planning of personal computers and EUC at the regional level is performed by the Information Systems Management Office (ISMO), the equivalent of the private industry's Information Center (IC). Unlike the USMC mainframe and telecommunications environments, the ISMO environment is loosely controlled from the Headquarters Marine Corps level. This fact has resulted in a "substantial inventory of incompatible equipment and software." (MCBul 5271, 1987, p. 4-6) This study concludes that the most significant limiting factor facing the Marine Corps' corporate strategy for control of its ISMO's is a lack of standards and specific direction. The requirement for developing a centralized, HQMC directed ISMO policy for control of ISMO resources was confirmed.

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I. INTRODUCTION

A. BACKGROUND

In the mid-70s, the United States Marine Corps' (USMC) leadership placed desktop computers in the hands of Marines who are not professional data processors. It subsequently directed that field commanders utilize this equipment in support of their administrative tasks. Further, HQMC encouraged users to develop both local administrative and tactical applications on this equipment as the commander saw fit. Since that time, some of the information needs of these "field" Marines have been met through their efforts with these personal computers. (Phillips, 1979)

The proliferation of end-user computers in the Marine Corps has been supported by the Marine Corps' own Information Systems Management Office (ISMO), the equivalent of private industry's Information Center (IC). Every major command in the Marine Corps utilizes the ISMO as the primary point of contact for data processing information needs. The terms IC and ISMO will be synonymous for this research effort. (Phillips, 1979)

As with any large organization, control and planning plays a significant role in the success of the ISMO. This is even more true for organizations such as the Marine Corps where life and death situations can be affected by the commander's

timely access to certain administrative and tactical information.

The Marine Corps faces many challenges in the area of planning for and control of its ISMO resources. As the computer skills of end users improve, paralleling society's maturation in the use of computers, changes will be needed. The burden of information gathering and reporting is shifting from the data processing professional to the user himself. This transition brings with it a potential shift in power away from the data processing group. The Marine Corps must decide what management level will best control ISMO resources.

B. OBJECTIVES

There are several approaches possible for the successful control of IC resources. The objective of this research is to determine the Marine Corps' current strategy and make recommendations for future. The primary research question for this study focuses on how the highest levels of USMC ADP leadership controls regional IC's and whether this method is effective. In order to answer the primary research question, a number of subsidiary questions are addressed:

1. What are the functions and benefits of IC's and what resources must be identified to support an IC structure?

2. What methods/models have been developed to control IC resources?

3. What is the environment of the USMC mainframe, deployed and telecommunications communities and how do they compare with the USMC IC environment?

4. What are the current policies and guidelines for USMC IC's and how did they evolve?

5. Is the USMC's control strategy for regional IC's demand/user-driven or organizationally/HQMC directed?

6. Where do the regional IC's fit in the command structure of major organizations and does this position effect the amount of budgetary support these units receive?

7. What level of standardization exists between regional IC sites for software, hardware, and communications resources?

8. What guidelines are provided for the purchase of ISMO resources?

C. SCOPE, LIMITATIONS, AND ASSUMPTIONS

1. Scope

An ISMO can be found in every major organization in the United States Marine Corps. For the purposes of this study, a major organization is one that is commanded by at least a Colonel and has at least 100 users. The Commandant of the Marine Corps directs, staffs and controls these units via the Command, Control, Communications, Computers and Intelligence Division (C4I) at Headquarters Marine Corps. References to the Director, C4I are only made in his capacity as the senior policy setter for C4 issues. His duties as the Director of Intelligence have no impact on this research effort. He is therefore referred to as the Director, C4 Division for the remainder of this thesis.

2. Limitations

It is impossible given existing time and financial constraints to travel to every ISMO in the Marine Corps. The

investigation of regional operations and reactions to directions from higher headquarters was obtained from Standard Operating Procedures (SOP) provided by some of these units, interviews via telephone, and a visit to two such sites.

3. Assumptions

The organizational stability of the ISMO structure for the near future is assumed. It is also assumed that the goals for ISMO management include the most efficient and cost effective manner of planning and control for these resources.

D. METHODOLOGY

The research methodology used for this research effort consists of three phases:

1. Phase One was a literature review on the subject of Information Centers. This includes an examination of academic research in this area and current IC practice in the private sector.

2. Phase Two was an investigation of the evolution and the current environment of the mainframe, RJE, telecommunications, and ISMO communities in the USMC. Interviews with key personnel were conducted using the questions outlined above as a guide.

3. Phase Three was an examination of the alternatives available to the USMC to control its ISMO resources. Utilizing established computer control models, a determination of the current degree of ISMO control in the USMC was accomplished. From these assessments recommendations were made.

E. ABBREVIATIONS/ACRONYMS

Abbreviations and acronyms can be found in Appendix A.

F. SUMMARY OF FINDINGS

The most significant limiting factor facing the Marine Corps' corporate strategy for control of its IC's appears to be the lack of standards and specific direction. This situation has created confusion and inefficiencies at the regional IC sites.

The need for developing a HQMC directed IC policy for control of IC resources was confirmed. Additionally, this research revealed a need to upgrade the telecommunications ability of regional IC sites. Regional IC sites have LANS to support data transfer between users. This ability does not extend to areas outside the region. No facilities were found that allow communications with the Marine Corps Data Network.

Establishment of a Marine Corps standard for EUC software was substantiated. Delegation of procurement authority to the user level coupled with no firm direction on software standards has resulted in a variety of incompatible software among IC regional areas. This situation has led to a regionalization of applications and the inability to share application efforts.

G. ORGANIZATION OF STUDY

The following provides a brief description of the contents of the remaining chapters

Chapter II, "The Information Center--An Industry Perspective," provides a literature review of various issues

surrounding the IC. The IC environment, mission, functions, benefits, organization, resources, and the future of the IC are presented. Chapter III, "Planning and Control Strategies/ Models," examines four models for planning and control of information resources: the Nolan Stage Model (1979), the Huff, Munro, and Martin Model (1988), the Alavi, Nelson, and the Weiss Model (1988), and the Euske and Dolk Alternative Models (1988). These models provide organizations with a tool to measure control of computer resources which is useful when planning future control activities.

Chapter IV, "USMC ADP Environment and Control Policy," is an in-depth look at the overall ADP atmosphere in the USMC. The mainframe, telecommunications and ISMO environments are presented and contrasted. Additional study into the ADP methods utilized by the Marine Corps when in a training or combat environment is conducted and contrasted with the IC environment. Chapter V, "The USMC's IC Posture in Models for Control," places the current Marine Corps corporate control strategy in each of the four models introduced in Chapter III. The final chapter provides a review of the research questions, summarizes the concepts presented, offers conclusions and recommendations, and provides related topics for future research.

II. THE INFORMATION CENTER--AN INDUSTRY PERSPECTIVE

A. THE ENVIRONMENT

1. The Information Center

"The information center is a place, a concept, a method of supporting users in achieving their own solution to business problems that require computer resources and data." (Carr, 1987, p. 325) In his article, "Management Considerations for an Information Center," Hammond describes an information center as follows:

> An information Center (IC) is a portion of the Information Systems (IS) development resource organized and dedicated to support the users of IS services in activities such as report generation and modification, data manipulation and analysis, spontaneous inquiries, etc. The fundamental premise underlying an IC is that if provided proper education, technical support, usable tools, data availability, and convenient access to the system, users may directly and rapidly satisfy a portion of their business area requirements that depend on an IS environment. (Hammond, 1982, p. 131)

"The IC is a new IS-user relationship, a relationship built on cooperation and a joint dedication to getting the job done." (Hammond, 1982, p. 133) White and Christy (1987, p. 451) describe it simply as a "center within a business organization which typically serves the needs of those who computerized information resources." With the widespread acceptance of the microcomputer, and the accompanying acceleration in computing literacy among users, the

information center of the 1980s has become a dominant factor in organizational computing.

2. <u>End User Computing</u>

In order to study the role of information centers, an understanding of the underlying concept of End User Computing (EUC) must be attained. There have been a number of definitions published. According to Bloom EUC is "the unstructured use of computers by someone who is not a professional in data processing." (Goldberg, 1986, p. 77)

EUC is overtaking the traditional paper shuffling functions because aggressive, knowledgeable users are utilizing end-user languages and improved man-machine interfaces to perform these functions more efficiently. Once the domain of highly educated scientists and engineers, these tools and innovative users are opening computing to the whole organization. Some companies have grown to the point that EUC now constitutes up to 50 percent of their computing resources. The high concentration of effort on EUC has led to new organizational forms to support this growing phenomenon. (Rockart, Flannery, 1983)

EUC has also been defined as the use of any size computing device by personnel who don't work in either data processing or MIS departments, to do tasks such as wordprocessing, spreadsheets and report generation. Other tasks performed by these clerical, management and operational people include modeling, simulation, data analysis, problem

solving, and interoffice communications. (White, Christy, 1987)

EUC comparisons to the mainframe environment have also been made. EUC can be viewed as the dual case of the centralized mainframe because instead of one centralized computer serving a large number of people, one person is served by one or more dedicated computers. EUC occurs when a person with few computing skills creates computing applications independent of professional programmers. (Euske, Dolk, 1988)

3. Origins of EUC and the IC

The factors which have caused EUC can be attributed to the increasing demand for information system services, the rapid advance of microcomputer technology, and the introduction of "user-seductive" software. This rapid growth in user involvement in the once sacred area of computing has led to a number of problems. Some of these problems are lack of control over information resource acquisition use, hardware and software incompatibility, and the lack of quality control over end-user-developed products. These problems have in part led to the birth of the IC. (Euske, Dolk, 1988)

The origin of the IC was largely a "grass roots" phenomenon instigated by the users and forced upon management by the work force. As frustrated business users developed "vigilante committees," problems surfaced. Management

realized that if it did not get on the wave of technology, corporate standards and controls would erode. (Garcia, 1987)

International Business Machines (IBM) is credited with originating the concept of the IC in the mid-seventies. This was in response to a growing number of request for systems and the resulting growing backlog in the MIS department for new development projects. IBM installed IC's in many of its offices and offered it to its customers with similar problems. (Carr, 1987)

The user's environment is seldom static as their requirements specifications are constantly changing. This frustrates the MIS department when developing a requested system. Developers often want to "freeze" specifications so the development effort can proceed in a stable environment. The reality of business is that things seldom "freeze." This leads to frustration on the part of the users. On the other hand, MIS personnel view users as unable to make up their minds about what they need in a system, as making unreasonable requests and as having little appreciation for the impact they have on other IS activities. Hammond (1982) argues that proper implementation of an IC will prove to lessen the frustration of both the users and the MIS personnel because both groups will make some basic commitments relative to report generation and data analysis.

Still another reason for the birth of the IC is user friendly programming languages. Fourth generation languages

are being used by end-users, often with little knowledge of the MIS department. These languages are often rejected by the professional data processors. Nonetheless, these tools find their way into the hands of the users through third-parties, time-sharing vendors and private sources. (Merlyn, 1987)

4. The Mission of the IC

The 1987 CRWTH IC survey describes the mission of the IC as the organization that trains and supports business professionals in computer skills so that "they can use corporate information resources to improve decision making and job productivity." (CRWTH, 1987, p. 1)

Other descriptions of the IC's mission include "to drive and nurture end-user computing" (Merlyn, 1987, p. 13) and "to provide users access to data on their own terms so that they can solve their own business problems." (Hammond, 1982, p. 133)

B. FUNCTIONS OF THE IC

There are a wide variety of functions performed by IC and the mix of these functions are driven by the needs of the business the IC supports. The key functions listed in the 1987 CRWTH survey are: analyze end-user requirements, train end users, select end-user hardware and software, furnish mainframe-micro telecommunications link, render hotline support, provide access to corporate data, provide computer

graphics facilities, and supply some application programming. (CRWTH, 1987) These functions are explained below.

1. Analyze End-User Requirements

Studying the requirements of end users is a large part of the service provided by an IC. An indicator of the growing maturity of IC's is the fact that the analysis of end-user requirements has overtaken training as the most common service of IC's. (CRWTH, 1987)

The IC staff can be used to support user requirements for IC services to upper management. By working with the IC staff during the estimation process, the user expects the IC to maintain its ability to support them in the future. Users feel a stronger case can be provided to management if the IC staff is involved in the estimation. (Hammond, 1982)

2. Train End Users

In order to effectively utilize their newly found processing capabilities, end users must be educated. (Perry, 1987) "Training end users is one of the most important functions of an IC." (Carr, 1987, p. 336) In today's business world, computer education and training is considered crucial to the success of the IC. (Guimaraes, 1986; Rockart, Flannery, 1983; Hammond, 1982) Hammond describes the need for training as the key to freeing IS personnel and to providing the user with timely information:

> Training and consultation are required to bring the users quickly to a level of confidence and proficiency with tools so that they can develop solutions without having to involve IS personnel and to deliver that service in a time frame

> consistent with the user's needs and the value of the information to the user. (Hammond, 1982, p. 134)

According to the 1987 CRWTH Survey, training end users is the only service area which has not grown over time. It remains however a large portion of the overall mission performed by the IC. (CRWTH, 1987) Training is considered a passive objective of the IC because it shows little in the way of a tangible product. The benefit of training the end user is realized only after the end user performs computer tasks he may not have without the training, for example increasing a user's self sufficiency in a particular spreadsheet package. (Klein, 1987)

3. Select End User Hardware and Software

IC's are taking over a large share of the data processing function of selecting hardware and software. (CRWTH, 1987) Selecting hardware and software for the user is considered an active service provided by the IC because it is oriented toward direct involvement or assistance to the users and shows a tangible product. (Klein, 1987)

Often hardware and software resources are provided by the IC for demonstration, training and casual work. Users can inquire about the relative strengths and weaknesses of various products from the IC staff. The IC acts as the resident expert on these products and provides the user with information concerning the current use of products within the corporation and industry. (Perry, 1987)

This function is important because it limits the number of products to a number that is manageable, will be of greatest value for the costs incurred, will provide useful utilities, and can be supported. (Carr, 1987) Although the IC may limit the number of software products it supports, the range of software tools available from the IC encompasses all sizes of computers. (Hammond, 1982) This was substantiated by the 1987 CRWTH IC survey which reported that the IC supports mainframe computers as well as micros. (CRWTH, 1987)

The IC also serves as a focal point for software and hardware vendors to communicate upgrade information to the users as a group. Testing of these upgrades is often done in the IC before being put into production by the company. (Panko, 1988)

In summary, the specific tasks performed by the IC in this functional area include evaluation of competitive equipment, obtaining demonstration products, obtaining computer resource discounts, providing processing resources, and maintaining hardware and software for the users. (Perry, 1987)

4. Provide Mainframe--Micro Link

The need for more and more information by users is evident by the increased use of the technology which provides the mainframe-micro link. The IC is the technical source for guidance in this area. Users identify a need for mainframe information and IC personnel provide it by arranging the

communications necessary. This service doubled in popularity in 1987 over 1986. This function may change the IC role of supporting simple, standalone applications to overseeing the development of complex applications. That is, the IC may become more like the MIS department. (CRWTH, 1987)

5. Provide Hotline Support

IC's often provide around the clock support to their users in the form of a telephone number users can call to ask questions concerning their computing efforts. (Carr (B), 1988) Hotline service support has had a modest increase in recent years. (CRWTH, 1987)

6. Provide Access to Corporate Data

A major issue for end users has been access to corporate data. Specifically, their complaint concerns their inability to either locate where data is stored in the corporation or how to extract the data once it's located. As a result of these complaints, the IC has become the user's key to the corporation's data. (Rockart, Flannery, 1983, p. 784)

Providing access to corporate data involves assisting IC users in obtaining centrally stored information for use on personal computers and for establishing and maintaining communication links between the central site and end user computing resources. (Perry, 1987)

Hammond (1982) states that users expect the IC to help them access the data they need. This may involve writing an extraction program to make a data file for the user or

directing the user to some other department that has the needed data. Many corporations assign responsibility for ownership of certain data to functional areas. The IC should be aware of these owners and ensure they are aware that other users are interested in accessing their data.

Specific tasks which the IC performs in this functional area are summarized by Perry as follows:

> ...converting data, preparing standardized data diskettes, coordinating data access between data base administration and end users, assisting end users in understanding data definitions and facilitating uploading of data to the central databases. (Perry, 1987, p. 33)

7. Provide Computer Graphics Facilities

As users develop more and more of their own applications, they are becoming aware of the graphics capabilities computers offer them. Equipment such as plotters and graphic printers cannot be cost justified in all user areas. For this reason, graphics equipment is often centralized in the IC and IC personnel provide users access to this equipment. A nine percent increase in graphics facilities provided by IC has been noted in recent years. (CRWTH, 1987)

8. Provide Applications Programming

Although applications programming is not the primary mission of the IC, the 1987 CRWTH Survey (CRWTH, 1987) indicated a 17 percent increase in this service being offered by the IC. As mentioned above, much of this increase can be attributed to the increase in telecommunications facilities

and the users' desire to share information with each other. The IC acts as the focal point for the exchange of this information. The IC works with all sections involved by setting up the software support and by doing some of the programming effort.

C. BENEFITS OF THE IC

According to Hammond, the establishment of the IC has resulted in benefits for almost everyone:

> The IC has established a new user-IS partnership which has benefitted the entire organization. Users benefit because their short-term, often one-shot, IS related business can be addressed immediately. The IS Department benefits because it can satisfy the short-term, one-shot user needs in a more efficient manner, thus being able to devote more of its resources to new project-oriented development necessary for the long-range success of the business. (Hammond, 1982, p. 159)

The finance and accounting departments make up the largest segment of IC users followed by the marketing and administration departments. (Garcia, 1987; CRWTH, 1987)

Some of the benefits of the IC which have been documented are described below.

1. Forestall Staff Increases

Some IC managers contend that use of an IC forestalls staff increases in user departments. These managers have convinced user department managers that widespread use of personal computers and the services provided by the IC has kept these departments ahead of their work until the budget was adjusted to support more personnel. (Kelleher (A), 1986)

One company, which tracked IC benefits, reported a significant portion of cost savings which avoided extra hiring. (Hammond, 1982)

2. Freeing of ADP Programmers

IC's free data processing programming staffs for more sophisticated projects. Before the use of IC's, ADP programmers had to be "jacks of all trades" because they were the only source of programming talent. They often had to get involved in "basic" programming tasks. IC's free these programmers for more strategic ADP tasks because the user, with the help of the IC, can create his basic applications independently. (Hammond, 1982; Carr, 1987)

3. Increased Productivity

"Increased job productivity is the No. 1 benefit of the IC, with 80% of the IC's in 1987 citing this as a benefit compared with only 60% in 1985." (Garcia, 1987, p. 16) An often cited justification for the IC is its tendency to increase individual productivity by delivering computational resources to the actual user. (Benson, 1983; Gerrity, Rockart, 1986) The total organization benefits because a scarce and valuable resource, the ADP programmer, is used in a more effective and cost-efficient manner. (Hammond, 1982; Carr (B), 1988)

4. Improved ADP/End User Relations

Relations between the end user and the ADP department have improved mainly because of the increased understanding of

computer issues on the part of the users stemming from the use of the IC. "Armed with new computer skills, end users are now automating routine, time-consuming clerical tasks with computer generated reports, graphs and spreadsheets." (Garcia, 1987, p. 16) The 1987 CRWTH survey found that 70 percent of the participants felt that user computer literacy increased while utilizing the IC. The survey described this as follows:

> There has been a thaw in the relationship between Data Processing and end users. End users working in tandem with Data Processing on business applications start to comprehend not only the jargon used by Data Processing but also its problems and value to the organization. (CRWTH, 1987, p. 3)

This improved literacy has made dealing with ADP issues easier for all concerned. The result has been a more harmonious relationship between users and the information systems department. (Carr, 1987, p. 332; Perry, 1987, p. 249, Carr (B), 1988, p. 145)

5. <u>Improved Decision Making</u>

"Implementation of IC's has improved the decision making ability of the user." (Carr (B), 1988, p. 147) Hammond (1982) states that using IC's results in improved access to information in the format desired by the users. In general the user has greater access information which is useful in the decision-making process.

Decisions in business are often time sensitive. Managers are always looking for ways to improve their ability

to respond to requests. Utilizing applications they developed, users can often respond to a wide variety of requests in a more timely fashion. (Hammond, 1982)

6. Freedom from Scheduled ADP Runs

Most corporations are dependent upon computer reports for almost all phases of business. Many of these reports are produced based on a static ADP processing schedule. One of the greatest advantages of creating and controlling a program is to be able to run it whenever it's useful rather than being bound by a formal scheduled "run" procedure. (Rockart, Flannery, 1983) With the assistance of the IC, the user has the ability to produce reports when they are needed with no regard for computer availability which they may not control.

7. Cost Savings/Cost Avoidance

The kinds of cost savings that are attributed to the IC include: reductions in hardware costs, software costs, people and the elimination of space and associated support functions. These costs are saved because the IC reduces the need for centralized ADP support. The cost avoidance savings are in the same areas as the cost savings but are attributed to the monies saved on future costs as opposed to past costs. (Perry, 1987)

Another cost saving which can attributed to the IC is in the area of software maintenance. The users' involvement in the creation of software products earns dividends in the area of software maintenance because the users are now capable

of doing some of the maintenance because of their initial involvement. User maintenance on their own software products reduces the learning curve for the maintenance effort and results in more timely fixes for software products. (Carr (B), 1988)

D. ORGANIZATION AND RESOURCES

1. Corporate Position of the IC

The IC's location within an organization varies from company to company. (Carr, (B), 1988) This section presents the issue of placement of the IC and criteria used to decide its placement.

The IC functions cannot be a secondary or collateral task given to an existing department. This type of arrangement leads to a deemphasis of the IC functions. The IC must be a distinct organizational unit. If it is not, the IC will be pulled by the end users or the mainframe staff to fight DP fires and will not have the identity in the users' mind that must be created if users are to seek support from it. (Panko, 1988)

The IC is being viewed not just as another function of application development, but rather as important in its own right and able to take its proper place in the management hierarchy. (Carr (B), 1988) There are strong arguments regarding whether the IC should report to the MIS director, or whether it should be an independent function. The answer

to this question will depend both on how the IC is viewed and the information processing infrastructure within a particular company. (Perry, 1987)

Placement of the IC within the organization is important to its success. When placed too high, it is often viewed as a tool of the IS. When placed too low, it is viewed as belonging to the functional manager charged with it, thus reducing its effectiveness. The most effective placement is at the same level as the development managers. This allows equal status with other project oriented managers in the corporation. (Hammond, 1982, p. 146)

2. Staffing the IC

The staffing of the IC can only begin after the level and type of service and the number of users to be served have been established. Staffing the IC with the right kind of people is very important. It is far better to go without staff than to hire the wrong individual for the job. (Perry, 1987) "An IC with a motivated manager and a reasonable number of personable, competent people will have a significant impact on end users' productivity." (Carr (B), 1987, p. 242)

a. Skills

The essential skills needed by members of the information staff include interpersonal relations, oral communications, written communications, enthusiasm, patience and diplomacy. Important skills include knowledge of the business, knowledge of the products, knowledge of data

processing and the ability to perform many tasks concurrently. (Perry, 1987)

b. The IC Manager

"The manager of the IC is the most important single resource of an information center." (Carr (B), 1988, p. 95) "The IC manager should have a combination of DP and non-DP background." (Carr (B), 1988, p. 15) For this reason, careful consideration should be given to the abilities, background, and communications skills of the candidate for this position. Hammond outlines the additional skills needed in the IC manager:

> In addition to the traditional functions of personnel management, planning, projection and control of resources, development of tactical plans to implement the strategical direction set for the IC, and interfacing to other portions of the organization, it includes the responsibility to develop, with the user, a statement of the value of the IC to the organization on some regular basis. (Hammond, 1982, p. 135)

The IC manager is also expected be a salesman for IC services. The manager must promote the IC to the organization and to individual user departments by means of presentations, visits, etc. (Perry, 1987, p. 96)

c. Analyst or Consultant

The analyst is generally the first person in the IC to work with the user. The analyst helps the users assess the validity of the IC approach for satisfying their needs and suggests software and hardware products to them. The product consultant is the expert in a particular area of support.

Consultants can be either hardware or software specialists and they offer more detailed assistance to the user. (Hammond, 1982) The functions performed by these employees include identifying new products to users, preparing user guides, training, developing methods for downloading information from the mainframe, and coordinating telecommunications activities. (Perry, 1987)

d. Product Specialist

Product specialists are experts in the product which they support. They help the user once the talents of the consultant or analyst have been exceeded. Product specialists stay current on the recent releases for their specific products and notify users of any new enhancements which may result. Each product specialist has general knowledge of other software products in order to understand how their specific products interface with other software. A new product specialist can usually support 20 users and be responsible for two to four packages. (Hammond, 1982)

e. Teachers/Trainers

The teachers/trainers address the basic training needs of the users. They conduct classes for the users and, where needed, for other members of the IC staff. Another subtle teacher responsibility is to generate respect for the intent and capability of the IC. (Hammond, 1982, p. 149)

f. Staff Ratio

The initial staff of an IC usually consists of a manager and two or three consultants. This will suffice for the first eight to 12 months. Additional staff can be added as support functions expand or the number of IC users increase. (Hammond, 1982)

The number of IC staff personnel per user is also an important issue. When too many IC personnel are available, it tends to create a frustrating situation for all concerned. One IC staff analyst should be available for every 50 end users. When determining these ratios, the users are considered those who deal directly with the IC staff and not an overall count of those who benefit from the services the IC provides. (Perry, 1987)

It is possible to have some staff fill more than one type of job in the IC. This should not be done when either job would be adversely affected. Analysts, consultants, and educators should concentrate on their own position and should not be moved to another position without adequate replacement. (Hammond, 1982)

3. <u>Hardware Resources</u>

The 1987 CRWTH survey indicates that IC support has increased not only for personal computers but also for to mainframes and mini-computers as well. Given this large increase in hardware use, the IC has become the center of attention for hardware issues. (CRWTH, 1987)

IC's are becoming the primary source of technical information when it comes to hardware purchases. About two-thirds of all Information Centers have to sign the purchase requisition before micro hardware or software may be bought, and nearly one-third can now sign off on mainframe expenditures. (Kolodziej, 1987)

The choice of whether to use microcomputers, larger computers or a mix of both involves current resources, available funds, staff availability to support each, and the nature of the end user community. (Carr (B), 1988) The mix is dependent on the operation in which the IC finds itself. The IC must have adequate hardware to support its operations. The required quantity of these resources must be based on the initial scope of operations with some consideration given to the first growth cycle. (Hammond, 1982)

A major role of the IC is to aid the firm in computer hardware planning. As technology changes, the IC must stay informed about these advances and recommend to management possible hardware changes which would give the corporation a competitive edge. (Klein, 1987)

4. Software Resources

Since the IC supports a wide range of customers, its support for software is often as varied as its customer base. More advanced users may need procedural languages such as BASIC or APL to do their required functions. Still other users may need text processors, report generators, and simple

command-level languages. Because no single language is available to meet all the functions needed by every user, a broad range of tools must be made available. (Rockart, Flannery, 1983)

IC support for software products reflects the spectrum of available software products on the market. The most popular applications are spreadsheets, information retrieval and reporting, and word processing. These tools give business professionals and administrative staff the ability to manipulate data and text, to generate business reports, and to perform "what-if" analysis. Applications for development of databases, electronic mail packages and business graphics also are growing in popularity. (CRWTH, 1987)

IC's have assumed the responsibility for PC software matters. IC staff also work with the users in certain languages to retrieve and manipulate centralized data found on the mainframe. (Ambrosio, 1987) The 1987 CRWTH survey reports that IC software tools involve all sizes of computers. (CRWTH, 1987)

E. IC ISSUES

In 1983, Rockart and Flannery (1983, p. 776) noted that EUC is poorly understood. "Having met its original goal of computer literacy, the IC in today's business environment faces a different set of obstacles." (CRWTH, 1987) A number of these issues are presented below.

1. Measuring the Contributions of the IC

Unlike traditional ADP shops, IC's produce no tangible product. Since the user does most of the work which results in a final product, credit often is given to the user for the results regardless of the amount of assistance the IC may have provided. The most the IC can hope for is mention of the help provided by the IC. It becomes increasingly difficult to quantify how much work has been done for the user by the IC. It has almost reached the point where the IC is viewed as a utility for the user. (Kelleher (B), 1986, p. 52)

When managers are looking for cost saving cuts, IC's have a hard time proving their effectiveness. (Kelleher, 1986, p. 2.) As a result of this problem, the IC has had difficulty in justifying its resources. The 1987 CRWTH Survey (1987) indicates that in 1985, IC's had virtually no problem justifying its resources. By 1988, 32 percent of the IC's surveyed listed resource justification as a major problem.

2. Managing and Controlling the Mature IC

No guidelines could be found which describe how to successfully manage a maturing IC, because the first generation is only now beginning to come of age. Managers find themselves struggling with how to serve an increasingly divided user base and how to avoid being left in the shallow waters of micro installation and training while the corporation moves on to the deeper issues of strategic information management. (Kelleher (B), 1986)

3. Economic Politics

The financial support of any organization plays a vital role in the organization's survival and the IC is no exception. When the IC was initially conceived, it was supported by management with a modest supply of manpower and money. As the IC grew in popularity, the novelty wore off and the IC found itself having to compete more strenuously for resources. Kelleher describes this situation as follows:

> Economically, IC's that pass beyond the honeymoon phase often find themselves caught between escalating user demands for resources and dwindling management enthusiasm for funding on faith. (Kelleher, 1986, p. 52)

4. Staffing

The 1987 CRWTH Survey IC survey (1987), indicates that of the managers interviewed, only the positions of manager and administrator were adequately staffed. Trainer, product specialist, application development specialist, and hotline consultant were down from the 1985 figures by 30 percent, 68 percent, and 16 percent respectively.

5. Effective Training

As outlined above, one of the key functions of the IC is training. The 1987 CRWTH Survey (1987) indicates that this function has been given less emphasis than it deserves for a number of reasons. The lack of qualified trainers, however, is at the center of this issue.

F. THE FUTURE

1. IC Promotion

In spite of significant advances in recent years in user involvement in computing, there is still a consensus in industry today that emphasizes the need for greater awareness of the organizational impact of personal computing. (Guimaraes, Ramanujam, 1986) The responsibility for the promotion of IC benefits rests squarely on the back of the IC itself. (Hurst, 1987, p. 35)

> IC encourages the promotion of the EUC by reviewing and approving requests for services, training end-users, maintaining data extracts, coordinating application development, and problem solving. (White, Christy, 1982, p. 451)

Methods for informing managers of the IC include newsletters, tours through the information center, bulletin boards, user groups, memos, and management training classes. Management training classes consist of courses that include management issues in microcomputing, managing time and budgeting with a micro. (Hurst, 1987; Perry, 1987; Carr (B), 1988; Tucker, 1987)

The image of the IC has been changing to the IC's benefit in the political battles found in every corporation. In many cases, growing independence has led to a change in the image these centers present to top management. "More IC's are becoming adept at making sophisticated self-promotional pitches to those who control the money." (Kolodziej, 1987, p. 17)

When promoting the IC, caution must be exercised in order not to offer more than can be supported. Advertised services must be provided or the IC will lose credibility. Some IC's have adopted a "policy of no promotion efforts in order to control the requests for IC services." (Carr, 1987, p. 332)

2. Strategic Planning

The demands on the IC and IC management will continue to grow as investments are made in new technology. It is important that only those services of highest value to the company as a whole be offered and supported by the IC. This can be accomplished through proper promotion and planning of high priority IC services. (Arnowdse, 1988)

By comprehending the forces of change and by establishing an appropriate strategic framework, end-user computing can successfully evolve while remaining compatible with the company's overall information systems strategy. Management is now recognizing the need to define a single architecture or planning structure to guide its information systems strategy. (Merlyn, 1987)

Hammond argues that IC managers should perform both short term planning and strategic planning for the IC. (Carr, 1987, p. 333) Many companies feel that the IC is continually strengthening the strategic role of computers in the organization. (Kolodziej (B), 1987)

What the IC does is often a mystery to the end users. Users must be in tune with the support the IC can provide in order to make internal plans accordingly. Rockart and Flannery state this clearly:

> End users today in many corporations are confused about the actions being taken by the information systems organization with regard to end user computing. They strongly desire to know exactly what support and what future direction they can expect form information systems management. This knowledge is necessary so that they can make informed decisions on the increasing number of computing alternatives available to them. (Rockart, Flannery, 1983, p. 783)

The issue of obtaining resources for the IC is one of which IC managers are acutely aware. The source for these resources is upper management. If IC managers can show that the efforts of the IC are in concert with the overall goals of the corporation, they stand a better chance of getting what they need. Besides reaping paybacks in productivity, IC's that put their resources behind strategic business applications also consolidate political power. (Kelleher (B), 1986)

The need for a strategic plan to guide the efforts of the IC is apparent. Arnoudse proposes a checklist of steps to address in strategic and tactical planning:

1. Develop a mission statement.
2. Determine the scope of the plan.
3. Develop strategic objectives.
4. Determine basic IC functions.
5. Determine the long-term objectives for each function.
6. Define the critical success factors for the IC.

7. Create a Tactical Plan that will get the IC from where it is now to where it wants to be as outlined in the Strategic Plan.

8. Create an Implementation Plan that outlines all activities and projects that the IC will be engaged in within the next 12 months and assign to staff.

9. Communicate the plan.

10. Review the Plan. (Arnoudse, 1988, p. 2)

G. SUMMARY

The IC in industry today is a viable part of the success of the organization. Fueled by user desires, the IC has taken its place among the more traditional departments in the organization. (Garcia, 1987; Panko 1988)

There are a wide variety of functions performed by the IC and the mix of these functions is driven by the needs of the business the IC supports. The functions include analyzing user requirements, training, hardware selection, software selection, telecommunication support, data access, graphics assistance, and certain level of application programming (CRWTH, 1987).

The benefits of an IC include freeing programmers, forestalling staff increases, increased productivity, improved end user relations, and improved decision making. (Hammond, 1982). The staff of the IC can only be determined after the services to be offered have been determined. (Perry, 1987). Staffing the IC with a motivated manager and a reasonable

number of personable people will have a significant impact on the end user's productivity. (Panko, 1988)

In spite of the benefits mentioned above, there is a need for the IC to show it is a viable asset to the overall company mission. IC management has found it difficult to define its product and subsequently difficult to compete for scarce resources such as people and monies to purchase hardware and software. Other problems facing the IC include the struggles in controlling the maturing IC and the need for effective training. (Kelleher, 1986)

Promoting the IC falls directly on the shoulders of the IC itself. (Hurst, 1987) The best way to ensure the survival of the IC in the future is to create a strategic plan that will parallel the overall strategic goals of the company the IC supports. (Arnoudse, 1988)

A strategic plan for IS must include IC's in its scope and this, in turn, involves considering the planning and control of EUC. The next chapter discusses the issue of EUC control in general and describes several models which have been developed for this purpose.

III. PLANNING AND CONTROL STRATEGIES/MODELS

A. BACKGROUND

Because of the rapid growth of EUC, management techniques for planning and controlling this new technology have had trouble keeping pace. IC's which have not put in place firm guidelines for control are now paying a high price. (Kolodziej, 1987, p. 17)

A number of models have been developed to deal with the information resources control issue. Some of these models are very similar while others are expansions upon earlier versions. This chapter discusses four models of information resources control: Gibson and Nolan's Stage Model; Huff, Munro, and Martin's EUC Model; Alavi, Nelson, and Weiss' Laissez Faire to Bureaucratic Model; and Euske and Dolk's Alternative Model. A brief description of each is provided.

B. NOLAN STAGE MODEL

In 1974, Gibson and Nolan and Gibson (1974) developed the Stage Model which attempts to describe the life cycle of ADP management by proposing four stages through which organizations pass when assimilating computer technology. The four stages are initiation, expansion, formalization, and maturity. The authors suggest that understanding these various stages and the issues that characterize each, can

better prepare management to control ADP growth within the organization. The model focuses on three areas of growth as the ADP department evolves: computer applications, specialization of ADP personnel, and growth in formal management control techniques.

During the initiation stage the first computers appear in an organization, usually as a cost savings tactic for a particular department. Because this department is the only one that will use this equipment, it assumes responsibility for control and operation of the computer. Management gives little or no thought to the long-term impact on personnel or the organization at this stage.

The expansion stage is characterized by exponential growth in computer use. This is primarily due to the decreasing cost of ADPE and the increasing computer literacy of the workers. Workers are seeing more and more applications for a computer which will increase their productivity. A steady increase in expenditures for hardware, software and personnel takes place in this stage. The number of applications and the number of skilled ADP personnel also increase during the Expansion stage. Often, the ADP manager is moved up in the organization and the computer function is consolidated under that individual's direction. There are few standards and ADP efforts center on application development.

During this formalization stage management realizes that computer proliferation is getting out of control. The

applications development effort has grown to a point that upper management feels a need to become more directly involved in the way its resources are being spent in this area. Steering committees are often established and centralization becomes the watchword for the control effort. Project controls, documentation, chargeout systems and quality control procedures are put in place in an effort to control the runaway ADP budget.

The maturity stage delivers the ADP manager to the ranks of senior management. The computer resource now returns continuing economic benefits to the firm, and is being applied to the major tasks of the organization. The authors point out that this stage is seldom completely attained because new technologies will force the cycle to return to earlier stages.

Nolan (1979) modified and expanded the Stage model by renaming the expansion stage to the contagion stage, renaming the formalization stage to the control stage and adding two stages, integration and data administration. In the integration stage, existing applications are retrofitted using data base technology, computer utility and user accounts are established, planning and control systems are tailored to reflect these changes, and the user is made more aware of his computer usage. The data administration stage is characterized by the integration of applications, the organization of a data administration function, control

through shared data and common systems, and a more effective accountability of user activity.

The new order of the stages in the Stage Model as a result of Nolan's modifications are: initiation, contagion, control, integration, data administration, maturity. An additional growth process, user awareness was also added.

Nolan explains that the DP budgets form an S-shaped curve:

> The basis for this framework of stages is the recent discovery that the EDP budget for a number of companies, when plotted over time from initial investment to mature operation, forms an S-shaped curve. The turnings of the curve correspond to the main events-often crises-in the life of the EDP function that signal important shifts in the way the computer resource is used and managed. (Nolan, 1979, p. 76-77)

Figure 1 (Nolan, 1979) clearly shows the increasing level of expenditures as the company progresses through the six stages.

Through mid-stage III (i.e., the Control Stage), DP management is concerned with the management of the computer. At some point in Stage III, there is a transition to the management of data resources. This transition involves not only restructuring the DP organization but also installing new management. (Nolan, 1979)

The amount of control or slack exercised by management affects the organizational learning of the computer function. In a controlled environment, all financial and performance management systems are used to ensure that DP activities are effective and efficient. In a slack environment, sophisticated controls are notably absent. Nolan points out

Growth processes						
Applications portfolio	Functional cost reduction applications	Proliferation	Upgrade documentation and restruction of existing applications	Retrofitting existing applications using data base technology	Organization Integration of applications	Applications integration "mirroring" information flows
DP organization	Specialization for technological learning	User-oriented programming	Middle management	Establish computer utility and user account teams	Data Resource Management	Data administration
		Transition Point				
DP Planning and control	Lax	More lax	Formalized planning and control	Tailored planning and control systems	Shared data and common systems	Data resource strategic planning
User awareness	"Hands off"	Superficially enthusiastic	Arbitrarily held accountable	Accountability learning	Effectively accountable	Acceptance of joint user and data processing accountability
Level of DP expenditures						
	STAGE I Initiation	STAGE II Contagion	STAGE III Control	STAGE IV Integration	STAGE V Data administration	STAGE VI Maturity

Figure 1. Six Stages of Data Processing Growth

that when an organization permits organizational slack in DP activities, it commits more resources than are necessary to get the job done. The result is higher costs which requires a firm commitment to the computer function on the part of the management.

In Figure 2, Nolan (1979) shows the appropriate balance (according to Nolan) of control and slack through the six stages. He states that the balance between control and slack is important in developing an appropriate management approach for each stage of organizational learning. An imbalance of high control and low slack in the earlier stages can impede the use of information technology. In the latter stages, an imbalance of low control and high slack can lead to explosive DP budget increases and inefficient systems.

Stages	Organizational Slack		Control		Objective of control systems
	Computer	Data	Computer	Data	
Stage 1	Low		Low		
Stage 2	High		Low		Facilitates Growth
Stage 3	Low	Low	High	Low	Contain supply
Stage 4		High		Low	Match supply and demand
Stage 5		Low		High	Contain demand
Stage 6		High		High	Balance supply and demand

Figure 2. Optimum Balance of Organizational Slack and Control

A typical pattern of starting and developing internal and external control systems exists in the Stage Model. Figure 3 (Nolan, 1979) shows that in the Integration Stage, when exclusive reliance on computer controls proves to be ineffective, inefficiencies of rapid growth begin to create another wave of problems. Redundancy of data complicates the use of control and planning systems. Demands grow for better control and more efficiency. (Nolan, 1979)

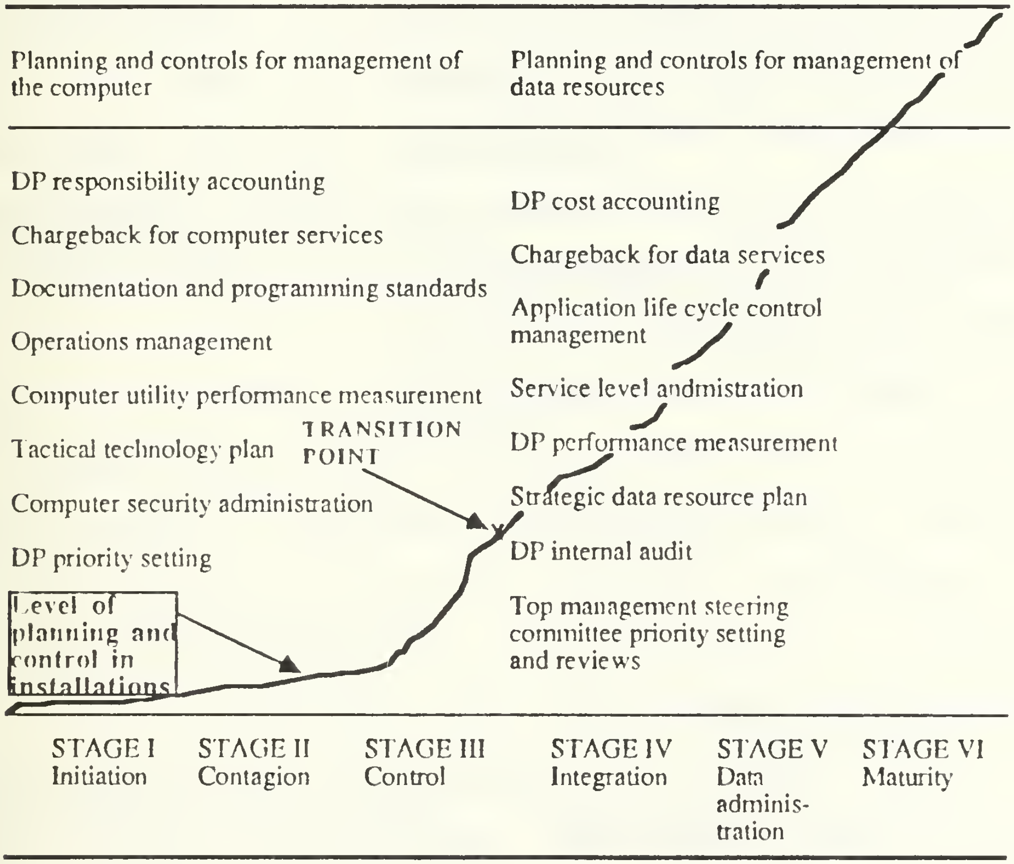

Figure 3. Growth and Maturation of Data Processing Planning and Control

C. HUFF, MUNRO, AND MARTIN EUC MODEL

Huff, Munro, and Martin (1988), propose a stage model fashioned after the Nolan Stage Model which is geared primarily to the growth of EUC. A framework has been developed based on the maturity of EUC applications.

The authors hypothesize that training, support and management activities are driven by individuals striving to acquire new skills and solve problems. They conclude that the maturity of applications is a measure that those skills are applied to the application's development. Operationally, application maturity is measured in terms of the interconnectedness of the applications with other components in its surrounding user computing environment. Knowing the level of application complexity will guide management in the control of its EUC growth.

Five stages, which are shown in Figure 4 (Huff, Munro, and Martin, 1988), have been developed based on the extent of application interconnectedness: isolation, stand-alone, manual integration, automated integration, and distributed integration.

1. Isolation Stage

In this stage most DP applications are primitive and little or no data is exchanged. Applications do little more than specific work-related tasks and they are not very sophisticated. The level of dependence on these applications is relatively low.

Stage	Extent of Interconnectedness
1. Isolation	Little or no exchange of data or programs with other applications.
2. Stand-alone	Applications operate in a stand-alone fashion; data for an application is keyed in manually.
3. Manual Integration	Data is transferred from application to application by manual file interchange (e.g., hand-carried diskette or manually controlled file transfers over a local area network or via one or more connected mainframes).
4. Automated Integration	Applications connect with one or more corporate databases and routinely transfer data between micro workstations and mainframe databases, or among mainframes, using automated processes designed into the applications.
5. Distributed Integration	Applications are part of a network which accesses data distributed throughout the organization; distinctions concerning the location of data (e.g., whether on a microcomputer or mainframe) disappear.

Figure 4. Stages of Application Maturity

2. <u>Stand-Along Stage</u>

Stand-alone end user applications become part of users' job activities and end user dependence on these applications is observable. The applications do not have interdepartmental range as they are usually restricted to one work area. Data passing is done through manual keying.

3. Manual Integration Stage

Applications maturity has developed to the point where much data is being exchanged between applications. The data exchange is done through manual intervention usually involving hand carried-diskettes or magnetic tapes. Use of local area networks (LAN) also occurs during this stage.

4. Automated Integration Stage

During this stage, applications are developed by users that employ effective automated connections among systems and data bases of all types. Users must know where the data exists in the corporate data base and how to access it.

5. Distributed Integration Stage

In this stage, end users share databases from desktop, departmental, and corporate levels. The physical location of the data is of no concern to the user and is taken care of by the application programs. There is little fundamental difference in the technology used by the user and the IS professional in this stage.

D. ALAVI, NELSON, AND WEISS MODEL

Alavi, Nelson, and Weiss (1988) confirm the need for explicit organizational strategy for the management of EUC, but argue that no single "best" strategy can be identified. Rather they identify and describe five different strategies: laissez-faire, monopolist, acceleration, marketing, and operations-based. For each strategy, a profile, which

consists of three dimensions of EUC management: policy setting and planning, support, and control, is presented. These profiles are based on the results of field observations conducted by the authors. Also a prescribed timing for the adoption of each strategy is proposed.

1. <u>Laissez-Faire Strategy</u>

This strategy is a "do nothing" approach toward EUC. Management provides little or no guidance for EUC activity nor does it expend much effort in the promotion of EUC. On the other hand few or no controls are placed on those wanting to experiment with EUC. When this strategy is used, no central organizational policies or procedures for EUC exist. As long as users use their own resources, they are allowed to purchase whatever they see fit to support their EUC activities. This strategy often leads to uncontrolled growth and a proliferation of incompatible EUC technologies and applications. As a result, this strategy is often replaced in order to inject some order in the EUC environment.

2. <u>Monopolist Strategy</u>

This strategy is more centralized in its approach to EUC control and management. In this model the authors argue that some governing body should control all aspects of information processing to include EUC. Specific control measures and procedures are set in place to enforce this strategy. This strategy leads to low growth and many times to missed opportunities for increased productivity and

organizational innovation. Many companies adopt this strategy in the belief that it will lead to efficient and cost-justified applications of EUC technologies. This strategy has been known to break down if adopted too early because its control mechanisms can't keep up with user demand fueled by decreasing costs of the technology. As a result, many departments purchase EUC tools regardless of the corporate strategy.

3. Acceleration Strategy

This strategy attempts to build enthusiasm for EUC by establishing an organization to support this effort. The organization most often identified with this strategy is the IC. The objective of this strategy is increased EUC activities and user satisfaction through education, support and consulting, all of which are functions of the IC. This strategy results in a rapid growth of EUC and encourages innovation and experimentation. The Acceleration Strategy often leads to an increased demand for high organizational investment in EUC. A problem often results in the firm's inability to support a growing end-user population.

4. Marketing Strategy

A marketing strategy is one of directed growth. In this approach, management influences the users by providing value added products and services in the form of free training or product support. Users are allowed to select anything they want to support their EUC activities but are coaxed towards

certain products by management's ability to lower their costs through volume purchases or site licenses.

The EUC support structure in a marketing strategy involves centralized, as well as decentralized, support groups. The centralized support group take a global, corporate perspective while a decentralized support group guides a particular department and accepts assistance from the centralized group. The central group can provided guidelines and direction to the end user as to what is feasible and desirable, as well as ensure that an appropriate policy and control framework is established. The decentralized group meets the individual needs of the users because of its technical, functional, and local applications knowledge. The result is a comprehensive and centrally coordinated distribution network.

5. Operations-based Strategy

This strategy utilizes control procedures, technological standards, and formal EUC planning activities to ensure the on-going management of equipment, software, personnel and other EUC resources. The goal of the Operations-based strategy is to maximize the efficient use of resources. EUC resources are integrated to ensure their efficient use. The same structure as in the marketing strategy, that of utilizing a centralized group for control and policy setting and decentralized groups to implement these controls, is used in this strategy as well.

Each of the strategies, which are shown in Figure 5 (Alavi, Nelson, and Weiss, 1988), differ in terms of objective, emphasis, organizational structure, and level of controls.

	Strategies				
Characteristics	Laissez-faire	Monopolist	Acceleration	Marketing	Operations
Objective	"Do nothing"	Contain and restrict EUC activities	Encourage and expand EUC activities	Expand EUC activities in certain form and directions	Obtain integration and efficiency in EUC activities
Emphasis	"Hands-Off" approach to EUC	Implementation of explicit controls Formal approval procedures	Provide support and broad-base education Highly responsive to end-user needs	Provisions of value added products and services Shaping the EUC demand	Standards Formal cost/ benefit analysis
Organizational structure	No formal structure	Management information systems/data processing department active in EUC containment and control	Centralized general support facility (e.g., IC)	Centralized facility for planning and coordinating Departmental support	Centralized planning, prioritization, and monitoring Departmental support and enforcing standards and control
Level of Control	Very low	Very high	Relatively low	Relatively high	High

Note: IC: information center

Figure 5. Characteristics of Different End-User Comuting Strategies

E. EUSKE AND DOLK ALTERNATIVE MODELS

Euske and Dolk (1988) contend that existing models don't successfully capture the EUC/IC environment. They feel that these models are largely based on a bureaucratic approach to control which requires only a relatively low user knowledge base to ensure compliance with the tight controls and standards typical of this environment. Euske and Dolk argue that a new era of computing literacy is evolving which opens the door for more flexible control models to be considered. They offer two alternative models as a basis for consideration in this user dominated, computer literate environment.

The first model is called the norm-based model which is characterized by increased end-user knowledge and acceptance of certain informal rules for using computing technology. Emphasis is placed on the informal control of EUC. Rules are not written down but understood informally by those in the environment. For example, one corporation may have an unwritten rule discouraging the use of computers for game playing, while another corporation may tolerate this type of action, all with no formal guidance from management. The norm-based model is described as an "unsteady state" found between the stable states of the bureaucratic environment and the virtual-market model.

The virtual-market model assumes a high level of user knowledge of hardware and software. Everyone is a computer expert. Controls are not needed because users know what

"good" and "bad" usage of hardware and software is and will therefore make the "correct" choices. Technology in this environment is viewed as a tool and a means to an end, not an end in itself.

A virtual-market environment requires adaptive user interfaces to deal with the different styles which users will exhibit. Integrative languages must be developed to allow users to interface with a wide range of environments. For example, a universal spreadsheet language would be desirable to allow Lotus 1-2-3 and Quattro users to work in harmony. The authors contrast this with the bureaucratic environment which requires users to use a specific language.

Dolk and Euske contend that the norm-based model is evolving as a result of EUC and the IC, and organizations then have a choice whether to move to either the virtual-market or bureaucratic model. If the virtual-market model were chosen, the organization would apply fewer controls, but would require more sophisticated software, whereas if the other were chosen, more controls would be applied.

The models described can be used for planning and control. Euske and Dolk hypothesize that end user computing is forcing organizations into the norm-based model. Knowing this, organizations can move to either steady state depending on the level of control they choose to apply. If a move to the bureaucratic model is chosen, high costs in architectural design and system maintenance, i.e., a system that ensures

end-users do not violate the rules, should be expected. On the subject of IC's, they describe this control as "effectively a de-facto loosening of control" or a move to the virtual-market model from the norm-based model.

F. SUMMARY

This chapter described four representative models which could be used to guide the control of information resources. Although none of them are all encompassing, they each provide the manager with insight into the cause and effect of certain actions during the management of EUC. Research continues on control strategies for EUC. "Many are concentrating on the control and support variables to the level of problems being experienced." (Guimaraes & Ramanujam, 1986, p. 179)

These models have been examined in order to present vehicles which the Marine Corps could use to implement an EUC strategy for the next decade. The next chapter describes the ADP environment in the Marine Corps.

IV. THE USMC ADP ENVIRONMENT AND CONTROL POLICY

A. INTRODUCTION

Understanding the Marine Corps' IC structure and IC issues is only possible with a full understanding of the overall Marine Corps data processing environment. This chapter examines the USMC ADP chain of command, the existing USMC ADP environment, and the policies which control these environments. Specific attention is paid to the ADP environments in the telecommunications, mainframe, deployed, and IC arenas.

B. THE USMC ADP CHAIN OF COMMAND

All chains of command in the USMC originate with the Commandant of the Marine Corps (CMC). The CMC directs the non-tactical ADP community through a series of executive committees and a HQMC Division headed by a Major General. The duties and functions of these committees and the C4 Systems Division are described below.

1. Assistant Commandant of the Marine Corps (ACMC) Committee

The ACMC Committee addresses programs dealing with non-tactical information systems. It is the highest level of planning, programming and budgeting for non-tactical ADP issues in the Marine Corps. This committee decides what

issues are forwarded to the CMC for decisions. (MCBul 5271, 1987)

2. Information Systems Steering Committee (ISSC)

The ISSC is the subsidiary of the ACMC Committee that oversees Information Resources Management (IRM) issues. This committee is made up of general officer representatives from each major HQMC division and each major Fleet Marine Force (FMF) command throughout the Marine Corps. This committee is chaired by the Director, C4 Systems Division (described below). The ISSC's functions include: establishing ADP procedures, setting direction for the use of information resources, overseeing the development of the Mid-Range Information Systems Plan (MCBul 5271, 1987), prioritizing information resources Program Objective Memorandum (POM) submissions to Congress, resolving resource conflicts, recommending alternatives to the ACMC committee, identifying sponsorship for ADP programs, ensuring compliance of life cycle management principles for each AIS, and annually reviewing each AIS under development. (MCBul 5271, 1987)

3. Information Systems Steering Groups

A steering group is created by the ACMC for each AIS development project which affects more than one functional area. The steering group's functions include: reviewing the project's progress at certain established milestones, redirecting or terminating the project if necessary, approving modifications, and presenting alternatives to the ACMC

Committee when a consensus can not be reached. Steering groups are made up of appointed officers. (MCBul 5271, 1987)

4. Director, C4 Systems Division (Dir., C4)

The Director, C4 is a Major General stationed at HQMC. He is the senior policy official for the planning, directing, budgeting and coordinating of staff activities relating to command and control systems, telecommunications, and information systems. His responsibilities include operational control over the Marine Corps Central Design and Programming Activities (MCCDPA's, described below), technical direction to the Marine Corps on ADP activities, assessing current and projected IRM support requirements, technical training, assignment of military and civilian ADP personnel, personnel management, technical support, setting security policies, and data administration. In the area of telecommunications, the Director, C4's responsibilities include data communications coordination, determining data communications requirements, ensuring responsiveness of the Marine Corps Data Network (described below), and coordinating data communications hardware and software requirements. (MCBul 5271, 1987)

C. MAINFRAME ENVIRONMENT

1. Regional Automated Services Center

In 1982, the Marine Corps established six RASC's located in the continental United States and the Pacific Ocean area. (MCO 5230.13, 1982) These facilities provide general

mainframe data processing support to units in their regional area. The Mid-Range Information Systems Plan (MRISP) (MCBul 5271, 1987, p. 3-6) describes the RASC's as follows:

> The RASC's are located at:
> Marine Corps Base, Camp Lejeune, North Carolina
> Marine Corps Air Station, Cherry Point, North Carolina
> Marine Corps Base, Camp Pendleton, California
> Marine Corps Air Station, El Toro, California
> Camp Smith, Hawaii
> Camp Kinser, Okinawa, Japan
>
> The RASC's are under the operational control of the commanding general of the base or station where they are located. The RASC's are organized, staffed, and equipped to provided data processing support to both supporting establishment and FMF organizations within their designated or geographical areas. The primary responsibilities of the RASC's are to provide day-to-day production support for all assigned Information Systems (IS) for designated activities, monitor telecommunication support to their users, provide local programming support, and perform trouble shooting services to supported activities. The RASC, Cherry Point and the RASC, El Toro provide primary data processing support only for naval aviation unique applications, and function as a remote job entry facility for all other applications. (MCBul 5271, 1987, p. 3-6)

2. Marine Corps Central Design and Programming Activities

In 1983, the Marine Corps created three MCCDPA's. Each is responsible for the development of information systems in their designated functional area. (MCO 5230.2D, 1983) These units also provide mainframe support to units in their regional area much like the RASC's provide. This "RASC function", provided by the MCCDPA's, is performed because no RASC is designated in an area where a MCCDPA exists. The MRISP describes the MCCDPA's as follows:

> The three MCCDPA's are located at:
> Quantico, Virginia
> Albany, Georgia
> Kansas City, Missouri

The MCCDPA's are under the operational control of the Director C4 Systems Division (HQMC). Within assigned functional areas, each MCCDPA is responsible for the design, programming, testing, implementation, distribution, documentation, enhancement, configuration management, and maintenance of Marine Corps standard application software. This includes application software developed or maintained with contractor support. In addition, designated MCCDPA's will act as sponsor for assigned standards system software products, providing detailed technical guidance, management, and control for those products. The MCCDPA's also function as regional service centers, except for operational control aspects, and provide data processing support to designated organizations within their geographical area. (MCBul 5271 1987, p. 3-7)

Figure 6 below shows the MCCDPA functional responsibilities (MCBul 5271, 1987).

FUNCTIONAL SUPPORT AREA	MCCDPA		
	QUANTICO	KANSAS CITY	ALBANY
Financial	X		
Operations	X		
Aviation	X		
Training	X		
Intelligence	X		
R&D	X		
Operating Systems	X		
Logistics			X
Manpower		X	
Disbursing		X	
Reserves		X	

Figure 6. MCCDPA Responsibilities

3. Remote Job Entry (RJE) Facilities

The Marine Corps maintains RJE sites in many of its outlying areas. The RJE sites were established simultaneously with the RASC's. (MCO 5230.2D, 1983) These facilities provide mainframe data processing support via smaller computers and provide large application support through telecommunications links to RASC's. The Mid-Range Information Systems Plan describes the RJE as follows:

> The RJE facilities are under the operational control of the commanding general/officer of the base or station where they are located. Each facility is equipped with a mini- or medium-scale computer, a communications processor or multiplexor, line printers and other peripheral equipment, and supports interactive terminals. The primary functions of an RJE facility are to provide day to day IS production support, limited programming, and trouble-shooting services for interactive terminals at the supported activity or base. (MCBul 5271, 1987, p. 3-6)

D. TELECOMMUNICATIONS ENVIRONMENT

The Marine Corps provides data communications services to its data processing sites utilizing the telecommunications technology of its own data network called the Marine Corps Data Network (MCDN). Front end processors, provided to each data processing computer, free the local processor of telecommunications services. This allows the local computer to perform data manipulation services only. The Mid-Range Information Systems Plan describes the MCDN as follows:

> The MCDN is a common-user data communications network which provides terminal-to-computer and computer-to-computer communications to Supporting Establishment and FMF units in garrison. The MCDN architecture is based on the use of communications processors as major nodal elements in the network. The communications processors perform front-end

> processing for all host computers, switching/line control for all terminals, and other network communications functions. Connectivity between nodal points is provided by leased circuits. MCDN will be used for all IS's for the Supporting Establishment and FMF units while in garrison. Terminals and other devices gain access to the MCDN primarily through dedicated circuits to the nearest nodal point. All terminals connected to the network can access any host computer in the network in an on-line, interactive mode. (MCBul 5271, 1987, p. 3-7)

A graphical representation of the MCDN is provided below in Figure 7. The lines connecting the nodes are telecommunications links. The thicker lines represent major trunks. The volume of traffic between HQMC, Washington, D.C. and MCCDC, Quantico, Virginia requires three major telecommunication trunks. (MCO P5230.14, 1983)

E. DEPLOYED ENVIRONMENT

Support to deployed units is provided via rugged minicomputers and van-mounted-medium scale computer systems. At least one minicomputer is provided to each battalion and squadron sized unit and one minicomputer is provided to each Marine Expeditionary Force. (MCBul 5271, 1987) These computers are described in more detail below

1. <u>Automatic Data Processing Equipment-Fleet Marine Force</u>

The Automatic Data Processing Equipment-Fleet Marine Force (ADPE-FMF) provides separate battalion and squadron sized units with the capability to capture data which will later be input to Class I AIS's. Class I AIS's are centralized mainframe systems used to account for various types of data such as pay, logistics, personnel, and

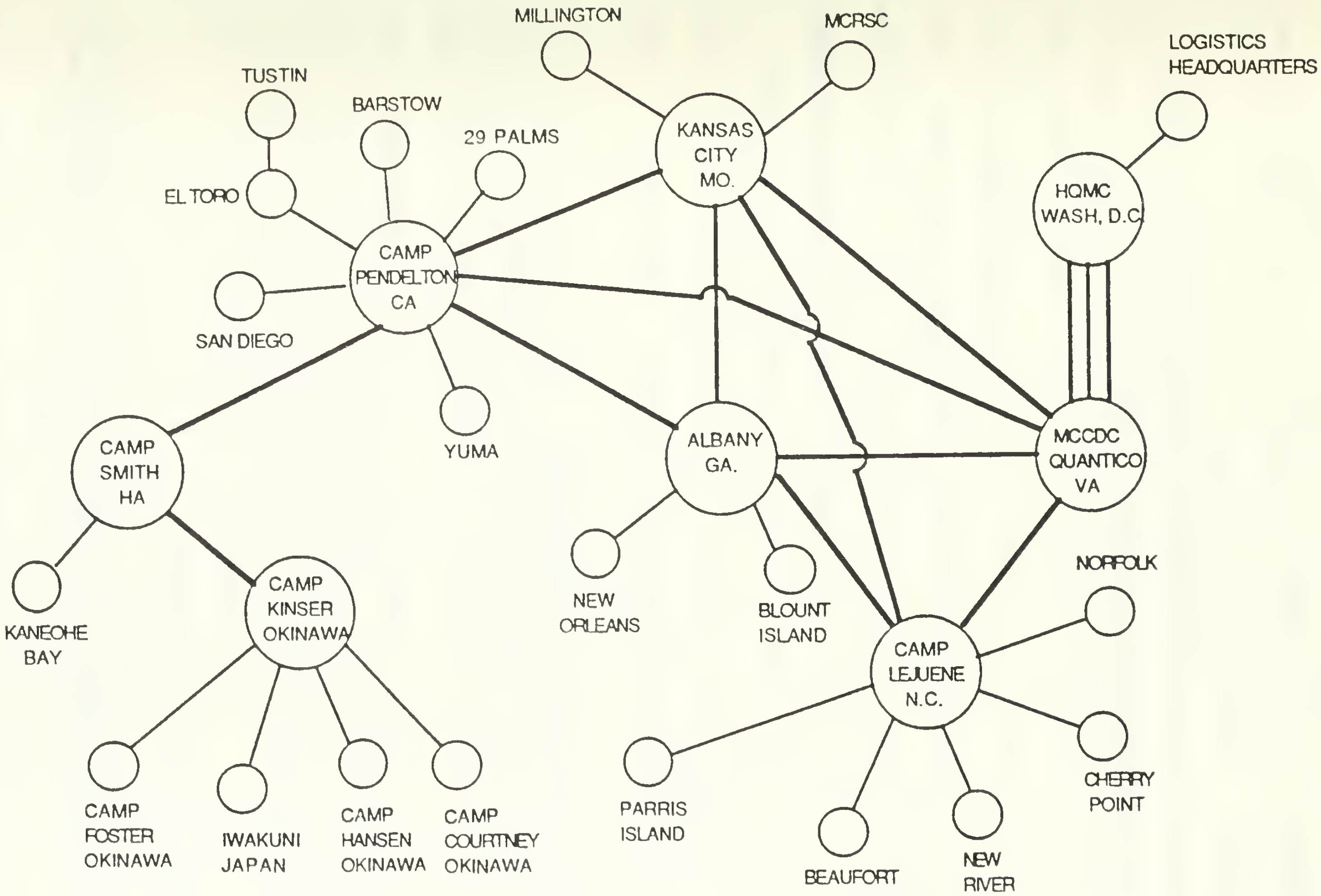

Figure 7. Marine Corps Data Network

administrative data. This equipment also provides the local commander the ability to create local applications. The ADPE-FMF equipment is a rugged version of the IBM series/1 minicomputer. (MCBul 5271, 1987)

2. <u>Deployable Force Automated Service Center (DFASC)</u>

The DFASC is an IBM 4341 mounted in two semi-trailer vans. These vans are capable of being transported to the amphibious objective area (AOA) by ship, rail, air or motor transport. The DFASC provides deployed units with data processing support while aboard ship or on an extended deployment. This equipment does aggregation of data for later processing at the closest RASC or MCCDPA. The DFASC is deployed during the logistics build up and is vital to the control of resources in this environment. (MCBul 5271, 1987)

F. INFORMATION CENTER ENVIRONMENT

The Marine Corps equivalent to the industry's IC is the Information Systems Management Office (ISMO). The ISMO acronym is also used to describe the officer who heads this office: the Information Systems Management Officer. The Marine Corps has 22 major ISMO offices found in FMF and garrison units. The Mid-Range Information Systems Plan describes the ISMO as follows:

> The ISMO is the primary staff officer for information resource matters within an FMF or Supporting Establishment command. The ISMO's functions include:
>
> 1. Advising the commander and his staff on information technology matters.

2. Acting as command focal point on all matters pertaining to coordination of information technology requirements, objectives, concepts, plans and policies, including establishing priorities with supporting and external data processing activities.

3. Exercising staff supervision of organic data processing units and equipment.

4. Preparing IRM support estimates, operating and contingency plans, and ensuring that these plans are tested. (MCBul 5271, 1987, p. 3-7)

1. Organization

The ISMO position in the organization is such that it facilitates liaison between the end user, the functional managers and the more traditional ADP support. The Information Systems Management Officer, is a principal staff officer on the General Staff. The end user support structure (Dir C4 Memo. 5231, 1988, p. 3) is described as follows:

a. End user. The end user in the ISMO environment is the average Marine or civilian found in an operational unit. This person may be an administration clerk, warehouseman, training clerk or an action officer at a high level in a major command. End users possess varying levels of data processing experience.

b. Information Systems Coordinator. This individual is found in the unit or department level and is usually an officer of high ranking enlisted or civilian. The Information Systems Coordinator acts as the unit's point of contact for data processing activities, coordinates training and provides assistance when possible.

c. Information Systems Management Officer. Next in the structure in the ISMO himself/herself. In addition to the functions described above, the ISMO seeks technical assistance from the units supporting RASC or MCCDPA. He/she translates user requests into terms more familiar to the data processing personnel in these activities.

d. RASC/RJE Facilities. As described above, the primary mission of these activities is to provide mainframe data processing support. However, the RASC's and RJE's provide

the ISMO with technical, administrative and limited programming support. Support is specifically offered for HQMC-provided software run on EUC equipment.

e. MCCDPA. The MCCDPA's provide design, programming, testing, implementation, distribution, documentation, enhancement, configuration management, and maintenance of Marine Corps standard application software that is run on EUC equipment.

f. Information Resources Management Branch (CCI, C4 Div.). This branch is responsible for all EUC function in the United States Marine Corps. It operates through the above structure and supports EUC programs base on the Marine Corps-wide guidance provided by C4 Division.

g. Functional Managers. Within the above structure, local functional managers are responsible to define, validate and support all EUC requirements. They are expected to train their users on the developed systems and determine when changes are required. The functional mangers are required to use the standards and guideline for EUC established by C4 Division.

2. Manning

Staffing of the ISMO organizations is based primarily on the size of the command it supports. Smaller ISMO sites often have an officer with no staff. This lack of staff is due primarily to a USMC manpower shortage. The larger sites are staffed with as many as five officers and approximately 60 enlisted personnel. (T/O Checklist, 1988) Figure 8 outlines a typical large ISMO organization. (SOP-II MAF ISMO, 1988)

As a result of a study done by a private contractor to examine the future of ADP in the USMC, a problem was identified in the area of staffing the ISMO. The USMC does not have enough ISMO personnel to support the number of end-users in the various organizations. The study also revealed

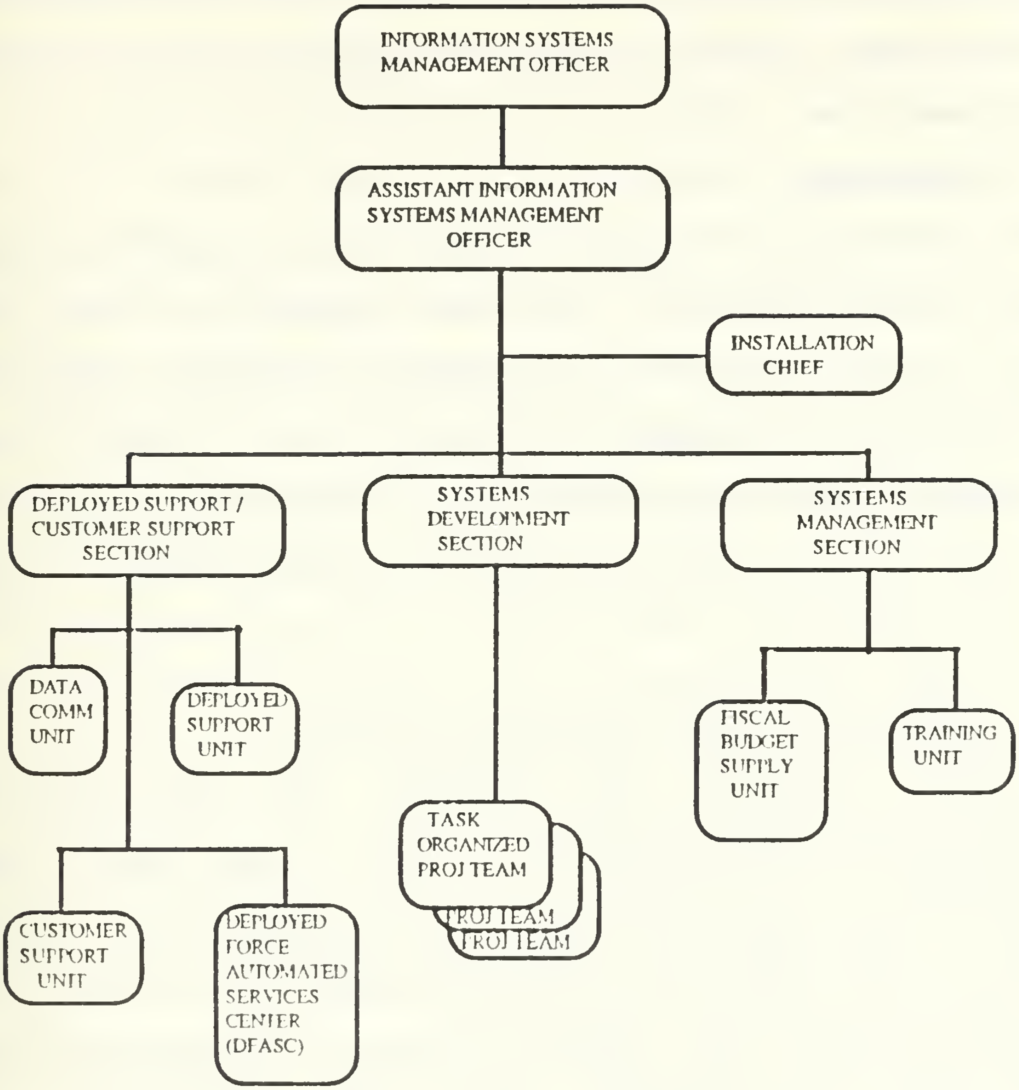

Figure 8. 2nd Force Service Support Group Organizational Chart

that commands which have a RASC or MCCDPA have developed "de facto" ISMO offices within these organizations to support and control the growing end-user community and to monitor

microcomputer system issuing and usage. This arrangement has in many cases caused a conflict of interest and poor support to the end user. (American Management Systems, 1987)

3. Funding

Funding for the ISMO offices is done primarily through local funding requests. The ISMO competes for funds with other staff offices in the command. Funding levels are determined by the ability of the ISMO office to justify needs, the support given ISMO initiatives by other departments and the commanding officer's interest in these issues. (Sims, 1988)

G. INFORMATION CENTER POLICY AND GUIDANCE

Official policy and guidance for the planning, implementation, and control of IC's in the Marine Corps originates in the formal chain of command described above. In spite of an official centralized approach to control of these activities, a more decentralized environment exists than would seem to be desirable. (Sims, 1988) ISMO's themselves have complained about the lack of guidance from higher headquarters. This situation has resulted in ISMO decisions being made with little regard to the overall impact the Marine Corps-wide ISMO issues. (Veseley, 1988; Coates, 1988; Hiester, 1988)

Due to the number of IC's in the Marine Corps and the uniqueness of the supported users from command to command,

implementation of the established policies and guidance is left to the discretion of the local commander. This approach to the control of the Marine Corps' IC's has resulted in different interpretations of the policies and guidance at various commands. IC's tend to establish regional control functions and standards with little or no consideration for IC activities outside their region. (Sims (B), 1989)

The Director C4 Division acknowledges his responsibilities as the principal figure in the centralized policy formulation for providing administrative data processing support, but also admits that enforcing his standards and guidelines for end-user computing is difficult. (Dir C4 Memo. 5231, 1988) This situation has resulted in the proliferation of a wide variety of microcomputer and office automation equipment to support various functions. "This has resulted in a substantial inventory of incompatible equipment and software." (MCBul 5271, 1987, p. 4-6) Local commanders make decisions based on the guidance given them by their ISMO. The decisions made for various EUC tools are often based on the best prices and deals the ISMO can obtain locally. (Sims (B), 1989)

This situation was compounded by the establishment of the Automated Data Processing Resource Delegation Program in 1984. This program allows commands to implement cost saving ADP solutions in a more timely manner by allowing local procurement up to established dollar thresholds. Presently, local commands can approve ADP resources after a competitive

solicitation up to $150,000. (CMC ltr. CCIR-03, 1985) Prior to establishing this program, HQMC handled these purchases and were able to control standards and guidelines for ADPE.

Due to the amount of ADP equipment which can be purchased within the directed limits, commands have unilaterally purchased equipment and software to meet their local needs with little consideration given to compatibility outside their commands. (Sims, (B) 1989)

Basic guidance is provided to the EUC field activities in the form of technical publications. This program was established to give the field the latest guidance because of the rapidly changing ADP environment. The Mid-Range Information Systems Plan describes this program as follows:

> Rapid dissemination of technical information is critical to the effective management of IRM activities. Information Resources Management (IRM) Standards and Guidelines Program, was promulgated on 19 September 1986. The purpose of the program is to facilitate rapid publication of and changes to technical direction relating to the management of IRM activities. More than 50 technical publications topics have been identified which cover all aspects of the management of information resources including such topics as requirements determination, acquisition, software development, configurations management and records management. Thirty-four technical publications have been published. Nineteen other technical publications have been drafted and are being staffed for comment. (MCBul 5271, 1987, p. 4-6)

H. MAINFRAME CONTROL VS. IC CONTROL

The control of USMC mainframe systems is based on years of experience. The mainframe systems tend to be large, functionally supported systems with a Marine Corps-wide impact. As a result, these systems get high level interest

both from the data processing community and the user community. Additionally, the dollar levels involved with the purchase of equipment and software in this environment dictate a centralized approach, often at the HQMC level. The mainframe, telecommunications, deployed, and RJE environments tend to be command driven. (Sims, 1988; Veseley, 1988)

Because the IC environment is treated as many individual pockets of ADP support, it tends to be a local issue. Decisions concerning IC purchases are made at the local command and are user driven. Because of this lack of interest at the higher levels of the Marine Corps, the IC community as a whole has relatively little standardization and Marine Corps-wide control. Local commands admit that a standard Marine Corps-wide approach to IC control is needed. (Sims, 1988; Veseley, 1988; Coates, 1988) They are hesitant to express these views officially, however, in fear that any adopted standard would be different from their current equipment and software, forcing them to replace their assets and retrain their staff and users. (Sims (B), 1989)

I. SUMMARY

This chapter provided an in-depth look at the Marine Corps ADP environment. This environment was broken into its many sub-categories: mainframe, telecommunication, deployed, RJE and IC. With the exception of the IC community, the Marine Corps has a centralized, command driven system to control its

daily ADP activities. In the IC environment, in spite of a proclaimed centralized approach to control, a "de facto" decentralized approach to control has emerged. The IC arena is driven by the needs of the local user. This situation has resulted in an inventory of incompatible hardware and software.

The next chapter applies the various models discussed in Chapter III to the current Marine Corps IC situation. Discussions of the future Marine Corps' IC environment are presented which include recommendations for management planning and control methods.

V. THE USMC'S IC POSTURE IN MODELS FOR CONTROL

A. INTRODUCTION

The Nolan Stage Model; the Huff, Munro, and Martin Model; the Alavi, Nelson, and the Weiss Model; and the Euske and Dolk Alternative Models, provide an organization with a tool to measure its control of computer resources in order to make decisions concerning the future of these resources. Chapter IV described the overall USMC ADP environment including the USMC ADP chain of command, the mainframe environment, the telecommunication environment, the deployed environment and the IC environment.

This chapter examines the USMC's ISMO planning and control strategy for EUC in the context of the four control models presented in Chapter III. The discussion focuses on IC planning and control from the corporate level; in the case of the Marine Corps, the HQMC level. In some cases, the ISMO environment at the local level is presented, but only to reinforce points concerning the overall USMC ISMO strategy.

B. THE USMC IC ENVIRONMENT IN THE NOLAN STAGE MODEL

As detailed in Chapter III, the Nolan Stage Model is a six stage model for planning and control of computer resources. It measures the growth of the applications portfolio, data processing organizational structure, data processing planning

and control, and user awareness. Once these measurements have been made, the model places an organization in one of the six stages according to its level of growth. Figure 1 provides a matrix of the stages versus the level of growth processes.

The Marine Corps' corporate level approach to EUC control is more decentralized than centralized. This strategy encourages EUC activities at the local level, provides guidelines in the form of general technical bulletins and provides an ISMO structure with little control from higher headquarters. (MCBul 5271, 1987; Sims, 1988; Veseley, 1988; Coates, 1988; Hall, 1989)

Given the USMC corporate EUC strategy described above, an evaluation of each Nolan growth process must be conducted in order to place the Marine Corps' corporate EUC strategy in one of Nolan's six stages. Figure 1 shows that Nolan's applications portfolio growth process provides categories which range from "functional cost reduction applications" to "application integration 'mirroring' information flows." (Nolan, 1979, p. 117) From a corporate or Marine Corps-wide viewpoint, the EUC strategy of the Marine Corps would fit somewhere in between these extremes.

This research did not reveal any evidence of an integrated applications effort between regional ISMO areas. Each ISMO site in the Marine Corps develops its own applications with little or no guidance from HQMC or consideration for other regional ISMO areas. (MCBul, 1987) Each ISMO regional area

concentrate its efforts on local applications designed to assist individual users. The applications which have been developed support this policy and show no indications of concern for activities outside the local area. (Sims, 1988; SOP, II MAF, 1988; SOP, 1st MarDiv, 1988; SOP, 2nd Mar Div, 1988)

Of the choices provided by the Nolan matrix, the Marine Corps' application's portfolio fits best in the "proliferation" category of the Contagion (Expansion) Stage. The Marine Corps' corporate EUC strategy calls for use of the ISMO for solutions to local data needs. This strategy encourages proliferation of EUC activities. It also encourages local programming efforts with little need for reporting these activities to higher headquarters. (MCBul 5271, 1987) The USMC strategy cannot be placed any higher in the matrix for this growth strategy because the remaining stages involve a higher level of direction and control than the Marine Corps provides its ISMO environment. (Nolan, 1979; Sims, 1988; MCBul 5271, 1987)

In the "DP Organization" growth process category of the Nolan Model, the USMC corporate EUC strategy would also seem to fit best in the Contagion (Expansion) stage. Nolan describes the growth process in this stage as extensive use of "user-oriented programmers" and "senior and middle management become frustrated in their attempts to obtain information from the company's computer-based systems."

(Nolan, 1979, p. 117) The establishment of teams to assist users in obtaining information independently of the mainframe applications (SOP, II MAF, 1988) and the existence of user-oriented programmers in the ISMO units would confirm that USMC management is frustrated and has taken these steps. (MCBul 5271, 1987) Many users look to solve their data needs themselves before looking to the major mainframe applications because they see the latter as a long process which often takes more time than the user has or is willing to invest. (Sims (B), 1989)

The corporate IC planning and control in the Marine Corps is decentralized. This is in contrast to the other ADP environments which are more centrally controlled by HQMC. The Marine Corps strategy does however provide for some direction from HQMC for its field ISMO activities in the form of generalized technical instructions. HQMC also provides some personnel training for ISMO personnel in the form of basic ADP training usually when a new officer or enlisted enters the ADP field. Additionally, HQMC transfers Marines in and out of the ISMO activities based on time on station and needs of the Marine Corps. (MCBul 5271, 1987)

Given the involvement of higher headquarters in certain aspects of local ISMO activities as described above, the Marine Corps' corporate "DP planning and Control" transcends more than one stage as described by Nolan. The "DP planning and control" growth process for the Marine Corps' corporate

EUC strategy has characteristics of "lax," "more lax" and "formalized planning and control." (Nolan, 1979) The first two characteristics have been outlined sufficiently to this point. The third characteristic of "formalized planning and control" must be considered because of HQMC's involvement in the support of the overall ISMO structure and the general guidelines it gives its ISMO centers. It cannot be considered however in the day to day decisions concerning purchases of software, training of users, level of involvement of ISMO staff, etc. Certain aspects of the Marine Corps' strategy for EUC within this growth process can be placed in the Initiation Stage, the Contagion (Expansion) Stage, and the Control Stage. This situation would contradict Nolan's model in that the Marine Corps' corporate strategy for control of its ISMO centers has strong characteristics of multiple stages for this growth process. (Nolan, 1979)

The last growth process in the Nolan model, "user awareness," is difficult to measure from the corporate level, because the "users" in this context are the individual ISMO sites in the Marine Corps. These "users" are more than "superficially enthusiastic" (Nolan, 1979) concerning IC matters, as it is their charter to promote ISMO activities within the organizations they support. (MCBul 5271, 1979) This would indicate that the Marine Corps' corporate EUC strategy cannot be placed in the first two stages of this

growth process, i.e., "hands off" and "superficially enthusiastic."

The Control stage of Nolan's model characterizes the "user awareness" growth process as "arbitrarily held accountable." (Nolan, 1979) This would best describe the Marine Corps' corporate strategy for regional ISMO organizations are given very general guidance from HQMC but are held primarily accountable to the commanding officer they support. Individual ISMOs are also "arbitrarily held accountable" by HQMC for the training of their personnel in general ADP matters, support to their users, and promotion of ISMO services. (MCBul 5271, 1987)

Figure 2 shows Nolan's arguments that certain combinations of organization slack and control will support certain objectives the organization sets for itself, and places an organization in one of the six stages as a result of these characteristics. Nolan describes these characteristics as follows:

> In the control environment, all financial and performance management systems-including planning, budgeting, project management, personnel performance reviews, and chargeout or cost accounting systems-are used to ensure that DP activities are effective and efficient. In the slack environment, though, sophisticated controls are notably absent. Instead, incentives to use DP in an experimental manner are present. (For example, systems analysts might be assigned to users without any charge to the users' budgets.) (Nolan, 1979, p. 116)

From a corporate perspective, the Marine Corps does not centralize its control of ISMO budgets, control project

management at the various ISMO sites, evaluate ISMO personnel from the HQMC level, or insist on a chargeout or accounting system for its ISMO sites. These attributes, coupled with a low level of interest in local ISMO activities places the Marine Corps' IC strategy high in organizational slack and low in EUC control. (Sims, 1988; Nolan, 1979; MCBul 5271) Nolan's arguments concerning levels of organizational slack and control places the current Marine Corps IC management strategy in the Contagion (Expansion) stage.

The above analysis of the Marine Corps' corporate EUC strategy in light of the growth processes and control versus slack of the Nolan Model, would place the USMC corporate strategy primarily in Stage II, The Contagion (Expansion) Stage. It must be noted that as outlined above certain aspects of the growth processes do fall outside this stage. Any movement to the latter stages in this model would have to include more stringent control measures from HQMC. (Nolan, 1979)

C. THE USMC IC ENVIRONMENT IN THE HUFF, MUNRO, AND MARTIN MODEL

The Huff, Munro, and Martin model is a tool which measures EUC growth based upon the maturity of EUC applications. Application maturity is measured in terms of the interconnectedness of applications with other components in its surrounding computing environment. Utilizing a stage model fashioned after the Nolan's model, the authors argue that

knowledge of the level of application interconnectedness will allow placing the organization in one of five stages. Figure 4 provides each stage and the level of applications interconnectedness found in each. (Huff, Munro, Martin, 1988)

The sharing of data between the various ISMO sites in the Marine Corps is limited to intra-regional areas. Regional areas have established local area networks (LAN's) to support the exchange of data between various organizations within the region or organization. (Sims (B), 1989; Veseley, 1988; Coates, 1988; Hall, 1989) Efforts to standardize a LAN operating system Marine Corps-wide have failed. (CMC msg R 210031z Oct 88) Established LAN's are not connected to the MCDN and there are no plans in the near future to establish gateways to this telecommunications backbone. (MCBul 5271, 1987) These facts limit the exchange of data between applications to local organizations controlled by individual ISMO's.

This situation causes the Marine Corps to be a mix in light of this model. Within the local regional areas, the interconnectedness of applications are more "mature" (Huff, Munro, Martin, 1988) given the ability to communicate between nodes. As mentioned above, there is no capability to share information between ISMO regions. It would follow that given these limitations, applications which exchange data with applications found outside regional areas are non-existent. (Sims (B), 1989; Veseley, 1988; Coates, 1988; Hall, 1989)

From the HQMC corporate perspective, the interconnectedness of applications as described by the Huff, Monroe, and Martin is better represented by the earlier stages of the model. The telecommunications limitations outlined above make it virtually impossible for data to be transferred in an automated manner except at the regional level. (CMC msg R 210031z Oct 88) The arguments given above place the Marine Corps' applications interconnectedness in the Manual Integration stage. Huff, Monroe and Martin describe this stage as follows:

> Data is transferred from application to application by manual file interchange (e.g., hand carried diskette or manually controlled file transfers over a local area network or via on or more mainframes). (Huff, Munro, Martin, 1988, p. 543)

It would seem, given the limitations, that data transfer between regional ISMO areas could be attained only by the hand carried option of this stage. (Huff, Monroe, Martin, 1988) Any movement to latter stages of this model would have to include a telecommunications vehicle to transfer the data between regional ISMO sites. Once such a telecommunications vehicle were in place, applications could be written to support such transfers.

D. THE USMC IC ENVIRONMENT IN THE ALAVI, NELSON, AND WEISS MODEL

Alavi, Nelson, and Weiss (1988) developed a model which identifies five strategies for control of EUC resources (see Figure 5). This model measures five specific management

characteristics: objective, emphasis, organizational structure, and level of control. The five strategies range from the least restrictive Laissez-Faire strategy to the most restrictive Operations strategy. (Alavi, Nelson, Weiss, 1988)

In order to place the Marine Corps' corporate EUC strategy in one of this model's five strategies, an evaluation of each characteristic must be conducted. It must be noted again that the perspective for this study is from the HQMC level and not from individual ISMO sites.

As mentioned earlier, the Marine Corps' corporate level approach to EUC control is more decentralized than centralized. It encourages EUC activities at the local level, provides guidelines in the form of general technical bulletins and provides an ISMO structure with little control from higher headquarters. (MCBul 5271, 1987; Sims, 1988; Veseley, 1988; Coates, 1988; Hall, 1989)

Utilizing the same arguments used in the earlier models, the strategy which best describes the Marine Corps' current approach to EUC control in this model would be the Acceleration Strategy, see Figure 5. The characteristics of this strategy are relatively low control, general IC support, high response to user, and encouragement of the expansion of EUC utilization. (Alavi, Nelson, Weiss, 1988)

E. THE USMC IC ENVIRONMENT IN THE EUSKE/DOLK ALTERNATIVE MODELS

The Euske/Dolk Alternative Models describe an unstable state of the norm-based model versus the stable states of the bureaucratic models and the virtual market models. They argue that organizations described by the norm-based model are in a position to make a decision to move to one of the two more stable states. (Euske, Dolk, 1988)

As described above for the other models presented, the Marine Corps' approach to EUC control is one of low control. There are no formal rules and software and Standing Operating Procedures (SOP) are not standardized. The Marine Corps allows local commanders to develop ISMO strategy with little regard for Marine Corps-wide implications. (MCBul 5271, 1987) This approach eliminates the Marine Corps' strategy from any bureaucratic model as described by Euske and Dolk. A bureaucratic approach would be more directive in nature and would control more closely the activities of the organizations involved. (Euske, Dolk, 1988)

The virtual market model is characterized as being focused on user productivity, the use of adaptive user interfaces and fewer controls but more sophisticated software. (Euske, Dolk, 1988) Although the Marine Corps' corporate strategy is one of few controls, the use of innovative macros to allow compatibility among the users is non-existent. Additionally, the level of corporate control does little to ensure user

productivity Marine Corps-wide. The Marine Corps' corporate strategy for EUC control, therefore, does not fit the virtual market model as described by the authors. (MCBul 5271, 1987; Sims, 1988)

The high level of knowledge at the local ISMO sites (SOP, II MAF; SOP, 1st MarDiv;, SOP, 2nd MarDiv) and the acceptance of the generalized nature of the rules provided by HQMC to its ISMO sites (MCBul 5271, 1987), would support placing the Marine Corps corporate strategy for ISMO control in Euske and Dolk's norm-based model. The USMC attributes described above fit well with this model's characteristics of increased user knowledge and acceptance of informal rules. (Euske, Dolk, 1988)

F. USMC IC ALTERNATIVES FOR IC CONTROL

The United States Marine Corps' ADP leadership faces at least two alternatives for control of the IC environment. The first would be to accept its current strategy of a lax approach to the control of these resources and to do little to standardize the IC environment issue Marine Corps-wide. This alternative leaves the control of the IC in the hands of the individual commanding officers as directed in the Marine Corps Mid-Range Information Systems Plan. (MCBul 5271, 1987)

The second alternative for control of the IC environment is to take a more centralized approach to the planning and control of the IC environment Marine Corps-wide. This would

involve adopting a more bureaucratic strategy which would force individual IC's to conform to a centralized plan. This alternative would require HQMC to take a more active role in standardizing IC's Marine Corps-wide and to some degree reducing the local commanding officers' control of these resources.

G. SUMMARY

This chapter placed the Marine Corps corporate level strategy for EUC control and planning in the four models for EUC planning and control presented in Chapter III. In the Nolan model, the Marine Corps' corporate IC strategy was best described by the Contagion (Expansion) stage and in the Huff, Munro, and Martin model by the Manual Integration stage. The Alavi, Nelson and Weiss model characterizes the Marine Corps' IC strategy best in Acceleration strategy. In the last model presented, the Euske and Dolk Alternatives model, the Marine Corps' corporate IC strategy is best portrayed by the norm-base model.

Two alternatives for future control of the IC environment were presented. The first suggests that the Marine Corps accept the status quo of decentralized control of its corporate IC resources, while the other alternative suggests a tightening of these controls by movement to a more bureaucratic approach. The final chapter recommends an alternative for control of Marine Corps' IC resources.

Utilizing the models presented, Chapter IV suggests what actions are necessary for IC planning and control as the Marine Corps enters the 1990s.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. RESEARCH QUESTIONS

The purpose of this study centered on defining the Headquarters Marine Corps' role in controlling its regional IC's and EUC resources. The primary question focused on effective methods by which the highest levels of USMC ADP leadership can control regional IC's. In order to answer the primary research question, a number of subsidiary questions were addressed:

1. What are the functions and benefits of IC's and what resources must be identified to support an IC structure?

2. What methods/models have been developed to control IC resources?

3. What is the environment of the USMC mainframe, deployed and telecommunications communities and how do they compare with the USMC IC environment?

4. What are the current policies and guidelines for USMC IC's and how did they evolve?

5. Is the USMC's control strategy for regional IC's demand/user-driven or organizationally/HQMC directed?

6. Where do the regional IC's fit in the command structure of major organizations and does this position effect the amount of budgetary support these units receive?

7. What level of standardization exists between regional IC sites for software, hardware, and communications resources?

8. What guidelines are provided for the purchase of ISMO resources?

B. METHODOLOGY

Initially, an in-depth literature review on the subject of IC's was conducted. It focused on current IC control strategies in the private sector and surveyed the IC's environment, functions, benefits, required organization and resources, issues, problems, and future.

The next phase involved interviews with USMC ADP personnel in key IC positions. A trip to HQMC resulted in discussions with ADP leadership. Due to fiscal constraints, additional interviews with regional ISMO leadership were conducted by telephone. The final phase was an analysis of the USMC IC environment in light of the EUC control models identified during the literature review.

C. CONCLUSIONS AND RECOMMENDATIONS

The primary conclusion is that the highest levels of ADP leadership in the Marine Corps control ISMO resources in a decentralized manner and that this approach has outgrown its usefulness and become ineffective. This conclusion was based upon the investigation of computing control models, the analysis of the USMC ISMO environment, and from the results of the interviews. The most significant limiting factor facing the Marine Corps' corporate strategy for control of its ISMO's appears to be the lack of standards and specific direction. This situation has created confusion and inefficiencies at the Marine Corps regional IC sites.

The control models studied indicated that the current USMC strategy was appropriate during the initial growth stages of the ISMO functions because it allowed for quick growth and acceptance of EUC. The models also indicated however that once this initial growth has been completed, corporate leadership must take control of these assets or suffer inefficiencies and high costs. Responses from the regional ISMO leadership indicated that the "field" sites desire more definitive direction from the headquarters. Findings to the subsidiary questions indicate that the ISMO offers the Marine Corps many benefits, but that control of this resource must become more centralized in order to manage these resources effectively in the future.

The use of IC's in support of EUC has resulted in organizational benefits for private industry and the military. Analyzing user requirements, training end-users, assisting hardware/software selection, providing limited programming support, and establishing access to corporate data bases are some of the functions being performed by IC organizations. These functions have resulted in organizational benefits such as forestalling staff increases, freeing ADP programmers for more sophisticated projects, increasing organizational productivity, improving ADP/end-user relations, enhancing decision making, and avoiding costs. As in any organization, resources must be allocated to the IC to ensure its success.

Of primary importance is proper staffing and organizational commitment.

Control models have been developed that can be used to understand the degree of organizational computer resource control. Four such control models: the Nolan Stage Model (1979), the Huff, Munro, and Martin Model (1988), the Alavi, Nelson, and the Weiss Model (1988), and the Euske and Dolk Alternative Models (1988) offer organizations a way to measure their current degree of computer resource control. These models were applied to the Marine Corps to determine the appropriate IC control strategy. Currently, the USMC manages its IC resources in a decentralized manner which is in complete contrast to the centralized approach it uses for its other ADP resources. The USMC mainframe, RJE and telecommunications environments are functionally supported by the logistics, fiscal and manpower communities. As a result, these environments command interest from the Marine Corps' high level leadership, the data processing community and the user community.

The ISMO has no functional community to "champion" its cause and tends to be a regional issue. Decisions concerning ISMO purchases are generally user-driven and made at the regional level. Lacking support from the higher levels of the Marine Corps, the ISMO environment receives relatively little standardization or Marine Corps-wide control.

The current USMC corporate policies and guidelines for ISMO issues emphasize guidance versus direction. HQMC publishes "technical guidelines" to its regional ISMO centers leaving final decisions to the regional ISMO areas. This has resulted in regional parochialism with the inherent politics which inevitable accompany such an approach. The models studied indicated that a centralized strategy would provide the advantage of volume purchases and centralized training. This would reduce the costs to regional sites and therefore to the Marine Corps as a whole.

The Information Systems Management Officer is a staff officer in every major Marine Corps command. This officer reports directly to the commanding officer and has only a technical data processing relationship with the ADP leadership at HQMC. This relationship is not a commander/subordinate relationship. The ISMO can seek technical guidance but answers to the regional commanding officer on all decisions. The ISMO is funded locally and the budget provided this office is directly affected by the degree of EUC interest displayed by the commanding officer and other staff sections. This has led to a different level of EUC support in different regions.

A need to upgrade the telecommunications capability of regional ISMO sites was identified. This conclusion was based on results of the study of the various USMC ADP environments and interviews with members of regional IC sites. Regional IC sites have LANs to support data transfer between users, but

this capability does not extend to inter-area transfer. No facilities were found which allow communications with the Marine Corps Data Network. This limits the regional IC site's ability to communicate with other regions causing a duplication of effort from region to region.

The requirement to establish a Marine Corps standard for EUC software was noted. The hardware which supports Marine Corps EUC was found to be relatively compatible. This is mainly due to specific guidelines established for the purchase of such equipment. The same situation does not apply to the software run on this equipment. The combination of user level procurement authority and no firm direction on software standards has resulted in a variety of incompatible software between ISMO regional areas. This situation has led to regional applications and the inability to share programming efforts. Regional ISMO leadership supports a standard Marine Corps-wide approach to EUC software, but are hesitant to express these views officially. Their hesitancy is base upon concerns that any adopted standard would be different from their current software, forcing them to replace their resources and retrain their staff and users.

D. SUMMARY

The benefits of IC's have been fully realized in the United States Marine Corps. Use of this organization has resulted in a proliferation of EUC which has taken a

significant portion of the programming effort away from more traditional MIS developers. The net result has been a benefit to the end users as well as the professional data processor. The benefits realized, however, are offset by the expense of a decentralized approach to ISMO control. Because of this corporate strategy, each regional ISMO site is duplicating the efforts of other sites. The costs associated with the continued use of this strategy are evident.

The USMC does not have to wait until individual ISMO regions declare they can no longer support their own EUC efforts due to budgetary constraints. A centralized approach to ISMO control is in the best interest of the Marine Corps' leadership, but more importantly is in the best interest of the Marine rifleman we all support.

The future of EUC in the Marine Corps is assured, therefore control of the ISMO must evolve with the growth of this phenomenon. As budget resources diminish, innovative managerial techniques must continue to find ways to provide more with less. The ISMO is no exception and must be addressed accordingly.

E. AREAS FOR FUTURE RESEARCH

The scope of this research was limited to a study of control methodologies for EUC and how these could be applied to the USMC. This effort uncovered a variety of areas for future research:

1. Research of the technical feasibility of integrating existing LAN's into the MCDN.

2. Analysis of the level of effort required to create, staff, and administer a HQMC section to control ISMO activities Marine Corps-wide.

3. Examination of existing software at the various regional ISMO sites and based on level on use, costs, and user friendliness, present a recommendation of a standard for various applications. Volume purchases and centralized training could be addressed. Particular attention could be paid to the areas most affected by such a standard and recommendations could be made for easing the transition.

APPENDIX

ABBREVIATIONS/ACRONYMS

ACMC	Assistant Commandant of the Marine Corps Committee
ADP	Automatic Data Processing
ADPE-FMF	Automated Data Processing Equipment for the Fleet Marine Force
AIS	Automated Information System
AOA	Amphibious Objective Area
CMC	Commandant of Marine Corps
EUC	End User Computing
Dir, C4	Director, Command, Control, Communications and Computer Division
DFASC	Deployable Force Automated Service Center
FMF	Fleet Marine Force
HQMC	Headquarters Marine Corps
IBM	International Business Machine
IC	Information Center
IRM	Information Resources Management
IS	Information Systems
ISSC	Information Systems Steering Committee
ISMO	Information Systems Management Officer/Officer
LAN	Local Area Network
MAF	Marine Amphibious Force
MEF	Marine Expeditionary Force

MCCDPA	Marine Corps Central Design and Programming Activity
MCDN	Marine Corps Data Network
MCO	Marine Corps Order
MRISP	Mid-Range Information Systems Plan
POM	Program Objective Memorandum
RASC	Regional Automated Services Center
RJE	Remote Job Entry
USMC	United States Marine Corps

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